

Terrestrial Forested Habitats:

(1) Old Growth Forests

Description:

Old growth forest historically occurred throughout Maryland, dominating the landscape and representing a broad range of forest types. Today, only scattered remnants remain in the state and elsewhere in eastern temperate North America. Old growth has been generally defined as forests in existence since pre-settlement times and lacking any significant, direct



Euro-American disturbance. It has also been referenced using such terms as primeval, climax, virgin, and ancient forest. An interesting account and description of the pre-settlement forest of Maryland can be found in Robbins and Blom (1996). In a recent, on-going effort by MD DNR to map and characterize extant old growth forest throughout the state, the following definition has been applied:

An old growth forest is a minimum of 2 ha (5 acres) in size with a preponderance of old trees, of which the oldest trees exceed at least half of the projected maximum attainable age for that species, and that exhibits most of the following characteristics:

1. Shade tolerant species are present in all age/size classes.
2. There are randomly distributed canopy gaps.
3. There is a high degree of structural diversity characterized by multiple growth layers (canopy, understory trees, shrub, herbaceous, ground layers) that reflect a broad spectrum of ages.
4. There is an accumulation of dead wood of varying sizes and stages of decomposition, standing and down, accompanied by decadence in live dominant trees.
5. Pit and mound topography can be observed, if the soil conditions permit it.

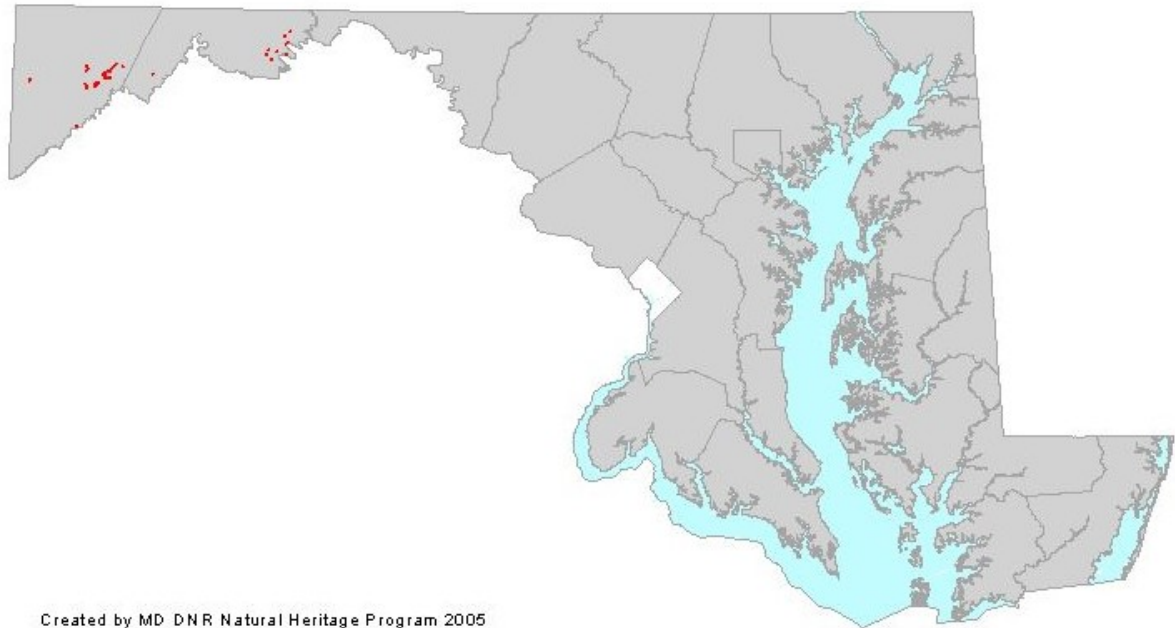
Location and Condition:

Although old growth forest was once a dominant feature throughout most of the Maryland landscape, only about 40 small, scattered remnants remain (MD DNR, unpublished data). The ongoing inventory for old growth forests on state lands has documented 1,679 acres of this important key wildlife habitat in western Maryland. This habitat is fragmented into small patches ranging in size from about 3 to 390 acres. Only five areas exceed 100 acres each. Most are considerably smaller (3-50 acres) and confined to isolated steep slopes, sheltered ravines or otherwise difficult to access areas where they were spared from logging and deforestation. However, their isolation and limited acreage, along with increasing degradation of the surrounding landscape (e.g., via fragmentation) has compromised their ability to support old growth flora and fauna and function as intact ecosystems. Many areas

are also threatened by logging, invasive plant species, introduced insect pests and pathogens, and disruption of natural disturbance processes.

Approximately 95% of all remaining old growth forest that has been documented during the ongoing inventory is located on state lands. The remainder is either on federal (0.4%) or private lands (4.7%). Some of the best remaining examples occur on Savage River State Forest and Potomac-Garrett State Forest in Garrett County.

Figure 4.1 Location of Old Growth Forests in Maryland documented to date (Source: MD DNR NHP)



GCN Species, Rare Natural Communities, and Other Wildlife:

Mammals		
Allegheny woodrat	Smoky shrew	Black-throated blue warbler
American marten	Southeastern myotis	Black-throated green warbler
Bobcat	Southeastern shrew	Blue-headed vireo
Delmarva fox squirrel	Southeastern star-nosed mole	Broad-winged hawk
Eastern red bat	Southern bog lemming	Brown creeper
Eastern small-footed myotis	Southern pygmy shrew	Brown-headed nuthatch
Eastern spotted skunk	Southern rock vole	Canada warbler
Hoary bat	Southern water shrew	Cerulean warbler
Indiana bat	Birds	Chuck-will's-widow
Least weasel	Acadian flycatcher	Common raven
Long-tailed shrew	American redstart	Dark-eyed junco
New England cottontail	Bald eagle	Eastern towhee
North American Porcupine	Barred owl	Golden-crowned kinglet
Northern flying squirrel	Bicknell's thrush	Hairy woodpecker
Rafinesque's big-eared bat	Black-and-white warbler	Hermit thrush
Silver-haired bat	Black-billed cuckoo	Hooded warbler
	Blackburnian warbler	Kentucky warbler

Louisiana waterthrush
Magnolia warbler
Northern goshawk
Northern parula
Northern saw-whet owl
Northern waterthrush
Olive-sided flycatcher
Ovenbird
Pileated woodpecker
Prairie warbler
Prothonotary warbler
Red-breasted nuthatch
Red-cockaded woodpecker
Red-eyed vireo
Red-headed woodpecker
Red-shouldered hawk
Scarlet tanager
Summer tanager
Swainson's thrush
Swainson's warbler
Veery
Wayne's black-throated green warbler
Whip-poor-will
Winter wren
Wood thrush
Worm-eating warbler
Yellow-bellied sapsucker
Yellow-throated vireo
Reptiles
Broad-headed skink
Cornsnake
Eastern box turtle
Eastern hog-nosed snake
Northern pinesnake
Northern scarletsnake
Timber rattlesnake
Wood turtle

Amphibians
Allegheny Mountain dusky salamander
Barking treefrog
Eastern mud salamander
Eastern narrow-mouthed toad
Eastern spadefoot
Eastern tiger salamander
Green salamander
Jefferson salamander
Long-tailed salamander
New Jersey chorus frog
Northern red salamander
Seal salamander
Wehrle's salamander
Inverts: Dragonflies & Damselflies
Arrowhead spiketail
Brown spiketail
Delta-spotted spiketail
Gray petaltail
Harlequin darter
Northern pygmy clubtail
Southern pygmy clubtail
Taper-tailed darter
Tiger spiketail
Inverts: Butterflies & Moths
A noctuid moth
A noctuid moth
American chestnut nepticulid moth
Appalachian blue
Carolina satyr
Chermock's mulberry wing
Chestnut clearwing moth
Compton tortoiseshell
Cypress sphinx moth
Dusky azure
Early hairstreak

Giant swallowtail
Golden-banded skipper
Gray comma
Great purple hairstreak
Hessel's hairstreak
Hickory hairstreak
King's hairstreak
Marbled underwing
Northern crescent
Palamedes swallowtail
Pepper and salt skipper
Phleopagan chestnut nepticulid moth
Pine barrens zanclognatha
Precious underwing
The buckmoth
Three-horned moth
West virginia white
Inverts: Beetles
Giant stag beetle
Six-banded longhorn beetle
Inverts: Spiders
Red-legged purse-web spider
Inverts: Land Snails
Angular disc
Bear creek slitmouth
Cherrydrop snail
Cylindrically-ornate wood snail
Rader's snail
Spruce knob threetooth
Striped whitelip
Rare Natural Communities
This is considered the highest quality condition/stage of any forested community and is therefore rare from that standpoint

In addition to the GCN species listed above, this key wildlife habitat supports a wide diversity of wildlife species. The following game species are found in this habitat type: white-tailed deer, black bear, eastern gray squirrel, eastern fox squirrel, red squirrel, red fox, common gray fox, coyote, fisher, common raccoon, Virginia opossum, striped skunk, long-tailed weasel, mink wild turkey, ruffed grouse, and American crow. Management plans and

conservation programs for these game species are currently being implemented by MD DNR, USFWS, and many other partners.

Threats:

- a. Conversion to other land uses or forest types that results in loss of habitat
- b. Pesticide use and contamination that directly or indirectly affects GCN species
- c. Incompatible management practices that result in degradation of habitat
- d. Development and land use, including roadways and trails that results in forest fragmentation and isolation
- e. Deer overbrowsing or other causes that result in loss of forest structural diversity
- f. Forest pest species that may have landscape-level effects
- g. Invasive/exotic species that result in degradation of habitat
- h. Lack of scientific understanding of appropriate habitat requirements and management for all GCN species
- i. Selective timber harvest and hemlock wooly adelgid that causes loss of spruce and hemlock components in some old growth forests
- j. Human disturbance, including ATV use, which results in degradation of habitat
- k. Altered fire regime which result in loss conversion of old growth conditions

Conservation Actions:

- a. **Conserve large blocks of contiguous forest where appropriate** *[Measure: # of acres contiguous forests conserved]*
- b. **Protect all old growth forest habitat and adequate forested buffers** *[Measure: # of acres old growth forest and buffers protected]*
- c. **Increase old growth forest habitats where feasible** *[Measure: # of acres additional potential old growth forest protected]*
- d. **Establish and maintain landscape-scale protected habitat and movement corridors;** *[Measure: # of acres protected habitat established; # of acres new corridors established and protected]*
- e. **Incorporate forest conservation actions into land use and land planning efforts by local, state, and federal agencies** *[Measure: # of local, state, and federal agency plans incorporating wildlife focused forest habitat management actions]*
- f. **Minimize fragmentation of large, contiguous forest blocks** *[Measure: % of large, contiguous forest blocks remaining unfragmented]*
- g. **Identify areas that will become future old growth forests** *[Measure: # of sites identified as potential future old growth forests]*
- h. **Develop incentives for private land owners to conserve old growth on their properties** *[Measure: # of incentives developed; # of new participants maintaining this habitat type]*
- i. **Develop and implement protocols to control invasive species in a manner compatible with GCN species** *[Measure: # of protocols developed; # of sites with management implemented]*
- j. **Limit access and educate the public about the value of old growth and its conservation to address human disturbance issues** *[Measure: # of sites with limited access and educational signage; # of educational materials developed and distributed]*
- k. **Develop habitat management guidelines for use by foresters and land managers and work with them to implement such** *[Measure: guidelines developed; # of sites with cooperative management project; # of acres of this habitat managed for GCN species]*
- l. **Restore spruce, hemlock and chestnut components where feasible** *[Measure: # of acres forest with spruce/hemlock/chestnut components restored]*

- m. Implement appropriate IPM practices to minimize the effects of serious forest pest species *[Measure: # of sites or acres with IPM practices implemented]*
- n. Limit the use of pesticides such that GCN species and this habitat are not adversely affected *[Measure: # of sites with reduced quantity or frequency of pesticide use]*
- o. Develop and implement protocols to control deer populations to reduce browsing levels *[Measure: protocols developed; # of sites with management implemented]*
- p. Restore degraded habitats through appropriate techniques *[Measure: # of acres degraded habitat restored]*
- q. Work with Maryland DOT to improve transportation planning for new roads to minimize fragmentation of habitat *[Measure: # or miles of new roads planned with comments/input to minimize forest fragmentation]*

Inventory, Monitoring and Research Needs:

- a. Initiate long-term monitoring studies of GCN species, including forest interior birds and invertebrates *[Measure: # of monitoring studies established; # of monitoring studies conducted]*
- b. Conduct research on basic ecology, breeding parameters and life histories of GCN species, especially invertebrates *[Measure: # of research projects conducted; # of research papers published]*
- c. Conduct species surveys and determine distribution and abundance of GCN species, especially invertebrates *[Measure: # of surveys completed]*
- d. Conduct research to determine habitat use and requirements, movement patterns and dispersal of GCN species, especially invertebrates *[Measure: # research projects; # of research papers published]*
- e. Determine forest matrix requirements *[Measure: development of matrix model; # of conservation actions modified and re-prioritized based on model]*
- f. Monitor forest health and pest impacts *[Measure: # of monitoring studies established]*
- g. Continue inventory for old growth forests on public and private lands throughout the state *[Measure: # of sites or acres inventoried]*

(2) Early Successional Forests

Description:

Early successional forests are upland areas dominated by shrubs and small trees (< 8 m tall). This habitat occurs statewide in five broad settings:

Recently logged forests. Early successional habitat begins to develop within one year of a timber harvest and may persist for 10-20 years or more depending, in part, on pre-harvest forest conditions, soil type, the size and type of regeneration cut (e.g., clearcutting, single-tree selection, shelterwood), and post-harvest silvicultural treatments (e.g., seedling plantings vs. natural regeneration, thinnings). Habitat suitability for most early successional species of conservation concern tends to peak 2-10 years following harvest. Many such species are no longer present once tree canopy closure is attained.



Succeeding nonforested land. Examples include former cropland, pasture, old fields and reclaimed strip mines that are reverting to a forested state via natural succession or plantings. Early successional habitat may persist for 10-20 years or longer depending, in part, on the size of the opening, surrounding habitat conditions, prior land use, site conditions and the degree of woody plant browsing by deer and other mammals.

Temporary natural forest openings. Natural forest canopy openings result from a variety of natural disturbances including windthrow, ice storms, fire, beavers, tree senescence, insect outbreaks and pathogens. Canopy openings can range in size from small (< 0.4 ha), scattered light gaps to extensive (> 100 ha) blowdown areas. Large tracts (10-100 ha or larger) of early successional habitat may develop following severe ice storms, tornados and hurricanes. In riparian areas, beavers and floods may create sizeable openings. Although not native to North America, moderate to severe gypsy moth outbreaks can also result in large areas of early successional habitat. The duration of these temporary openings varies from a few years in scattered light gaps to several decades or more in large, catastrophic disturbances and extensive beaver-impounded areas. While some early successional species occur in small light gaps, habitat suitability for many early successional species tends to be greater in larger (> 2 ha) openings. Generally, the size and frequency of natural canopy openings increases with forest age although other factors (e.g., forest type, elevation, slope) are also important. Extensive tracts of mature to old growth forest can be an important source of early successional forest via temporary natural forest openings.

Shrub-dominated natural communities. Shrubs and small trees perpetually dominate a number of natural community types and ecotones. These conditions may occur within shale barrens, sandstone glades, dry oak-pine forests, maritime forests and shrublands and along

extensive, ridgetop rock outcrops. Some early successional species of conservation concern also occur in nontidal and tidal shrub wetlands, and shrubby ecotones within Carolina bays, Allegheny Plateau “bogs” and upper tidal marsh fringes. These are described later within their respective key wildlife habitat sections.

Forest edges. Forest edges are usually abrupt, narrow (usually 1-10 m wide), linear ecotones between a forested and nonforested habitat (e.g., cropland, road, transmission line right-of-way, backyard) or between two dissimilar forest age classes (e.g., a mature forest and a recent clearcut). These conditions can provide early successional forest habitat for some of the more generalist wildlife species, especially if a “soft” edge or gradual transition between the two adjoining habitats is present.

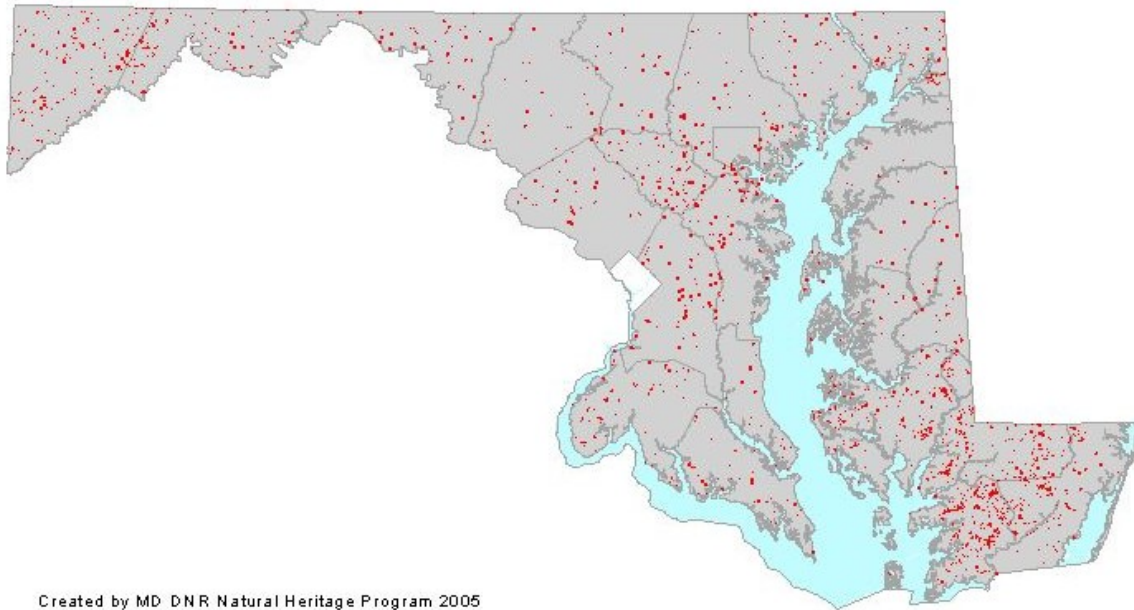
Location and Condition:

The historical extent of early successional forest in Maryland is uncertain. It may be comparable to today’s acreage (~5% of the land area; Frieswyk 2001) but certainly the origin, distribution and characteristics of today’s forms of this habitat are, in many cases, quite different. Prior to widespread European colonization, fires set by Native Americans and settlers and, to a lesser degree, lightning strikes, played a major role in creating and sometimes perpetuating forest conditions dominated by shrubs and small trees. Herbivores (e.g., beaver, bison, and elk), topography, edaphic conditions and storm-related events (e.g., floods, ice storms, and tropical storms) also played a significant role. Together, these agents of change maintained a shifting mosaic of early successional habitat embedded within a landscape that was likely dominated by old growth forest and a variety of grassland, shrubland and wetland habitats. The degree to which these factors affected the landscape varied by region and with local conditions (e.g., soil type, forest type, slope, and aspect).

Today, the majority of Maryland’s early successional forest is in the form of forest edges and recently logged forests. The latter comprises approximately 291,000 acres or about 4.7% of the land area in Maryland (Frieswyk 2001). This habitat is particularly common on the lower Eastern Shore with an estimated 81,000 acres (16.4% of forest land), followed by Allegany and Garrett Counties with 56,000 acres (12.2% of forest land). Information is lacking on the extent of some shrub-dominated natural communities and temporary natural forest openings but the acreage and benefit to early successional species is probably significant.

As Maryland’s landscape becomes increasingly fragmented and converted to residential and commercial development, the amount of forest edge will increase, benefiting some of the more generalist early successional forest wildlife species. However, opportunities for creating or restoring (e.g., via prescribed burns, logging, natural succession) other forms of early successional forest will dwindle due to habitat loss, fragmentation and the related effects of parcelization. Maintaining natural shrubland communities, old fields, and other forms of early successional habitat is critical since forest edges support relatively few early successional habitat specialists including those that are area-sensitive or dependant on naturally occurring shrublands. Increases in forest edge frequently also come at the expense of species requiring large, unfragmented forests.

Figure 4.2 Location of Early Successional Forests in Maryland (Sources: MD Dept of Planning; MD DNR NHP)



GCN Species, Rare Natural Communities, and Other Wildlife:

Mammals	Blue-winged warbler	Willow flycatcher
Bobcat	Brown thrasher	Reptiles
Eastern red bat	Chestnut-sided warbler	Eastern hog-nosed snake
Least shrew	Common raven	Timber rattlesnake
North American Porcupine	Eastern towhee	Amphibians
Snowshoe hare	Field sparrow	Eastern spadefoot
Southeastern shrew	Golden-winged warbler	New Jersey chorus frog
Southern bog lemming	Least flycatcher	Inverts: Butterflies & Moths
Birds	Mourning warbler	Indian skipper
American woodcock	Nashville warbler	
Bachman's sparrow	Northern bobwhite	Rare Natural Communities
Bewick's wren	Prairie warbler	unknown

In addition to the GCN species listed above, this key wildlife habitat supports a wide diversity of wildlife species. The following game species are found in this habitat type: white-tailed deer, black bear, red fox, common gray fox, coyote, common raccoon, Virginia opossum, striped skunk, long-tailed weasel, eastern cottontail, woodchuck, wild turkey, ruffed grouse, northern bobwhite, ring-neck pheasant, American woodcock, mourning dove, American crow, and fish crow. Management plans and conservation programs for these game species are currently being implemented by MD DNR, USFWS, and many other partners.

Threats:

- a. Conversion to other land uses or forest types that results in loss of habitat
- b. Pesticide use and contamination that directly or indirectly affects GCN species
- c. Incompatible management practices that result in degradation of habitat
- d. Development and land use, including roadways and trails that results in forest fragmentation and isolation
- e. Deer overbrowsing or other causes that result in loss of forest structural diversity
- f. Forest pest species that may have landscape level effects
- g. Invasive/exotic species that result in degradation of habitat
- h. Lack of scientific understanding of appropriate habitat requirements and management for all GCN species
- i. Lack of disturbance and lack of recruitment allowing succession over time
- j. Perceived lack of value by developers and the public
- k. Removal of topsoil from agricultural fields that could revert to this habitat

Conservation Actions:

- a. **Develop habitat management guidelines for use by foresters and land managers and work with them to implement such** *[Measure: guidelines developed; # of sites with cooperative management project; # of acres of this habitat managed for GCN species]*
- b. **Utilize landowner incentive programs, including Farm Bill programs, to develop and maintain this habitat type** *[Measure: # of sites or acres with this habitat developed/maintained through landowner incentive programs; # of new participants maintaining this habitat type]*
- c. **Work with farmers to conserve and manage for this habitat on marginal croplands** *[Measure: # of sites with cooperative management projects; # of acres marginal cropland managed for this habitat type]*
- d. **Conserve appropriate corridors for movement and dispersal of GCN species;** *[Measure: # of acres forest corridors conserved]*
- e. **Conserve large blocks of contiguous forest where appropriate** *[Measure: # of acres contiguous forests conserved]*
- f. **Develop and implement protocols to control invasive species in a manner compatible with GCN species** *[Measure: # of protocols developed; # of sites with management implemented]*
- g. **Incorporate forest conservation actions into land use and land planning efforts by local, state, and federal agencies** *[Measure: # of local, state, and federal agency plans incorporating forest wildlife focused habitat management actions]*
- h. **Allow beaver maintained openings to persist** *[Measure: # of sites maintained by beavers]*
- i. **Minimize fragmentation of large, contiguous forest blocks** *[Measure: % of large forest blocks remaining unfragmented]*
- j. **Work with sportsmen organizations, such as Quail Unlimited, to promote and manage this habitat** *[Measure: # of groups with cooperative management projects; # of acres managed for this habitat type]*
- k. **Mimic natural disturbance patterns** *[Measure: # of sites or acres managed through mimicry of natural disturbance patterns]*
- l. **Limit the use of pesticides such that GCN species and this habitat are not adversely affected** *[Measure: # of sites or acres with reduced quantity or frequency of pesticide use]*
- m. **Develop and implement protocols to control deer populations to reduce browsing levels** *[Measure: protocols developed; # of sites or acres with management implemented]*

- n. Implement appropriate IPM practices to minimize the effects of serious forest pest species *[Measure: # of sites or acres with IPM practices implemented]*
- o. Restore degraded habitats through appropriate techniques *[Measure: # of sites or acres with degraded habitat restored]*
- p. Protect and restore topsoil *[Measure: # of sites with topsoil protected or restored]*
- q. Work with Maryland DOT to improve transportation planning for new roads to minimize fragmentation of habitat *[Measure: # or miles of new roads planned with comments/input to minimize forest fragmentation]*

Inventory, Monitoring and Research Needs:

- a. Determine management needs and best management practices for populations, especially effects of various habitat management practices on species' productivity and on long-term habitat suitability *[Measure: # of BMPs developed; # of conservation actions with BMPs incorporated]*
- b. Monitoring programs should accompany management activities to assess effects of techniques on GCN species and long-term habitat suitability *[Measure: # of monitoring programs designed to assess effects of management actions]*
- c. Conduct a thorough inventory of existing shrub habitat to determine the most important sites for breeding populations *[Measure: # of inventories completed; # of acres inventoried]*
- d. Determine precise habitat characterizations and needs of GCN species, including area sensitivity, habitat quality, and habitat availability *[Measure: # GCN species with habitat needs determined; # of studies designed to determine habitat needs; # of research papers published]*
- e. Conduct studies on the factors limiting species abundance, such as predation rates, reproductive success, parasitism rates, and causes of mortality *[Measure: # of GCN species with studies of population-limiting factors; # of studies designed to determine population-limiting factors; # of research papers published]*
- f. Determine the frequency of occurrence of natural disturbance regimes and where they occur in MD's landscape *[Measure: # of studies of natural disturbance regimes in MD; # of research papers published]*

(3) Maritime Forests and Shrublands

Description:

Maritime forests and shrublands are found within Coastal dune systems and flats along the Coastal regions and barrier islands in Maryland.

The distribution and vegetation of these habitats is largely controlled by oceanic influences such as salt spray and deep sand deposits. Although oceanic influences are the primary contributing factors in vegetation structure and distribution, soil moisture and



drainage also play a critical role in shaping these habitats. Shrublands or “scrub” vegetation develops on inland edges of back dunes and leeward dune slopes where they are moderately protected from ocean salt spray. The vegetation is best characterized as “scrubby” in appearance typically including stunted trees and low growing, dwarfed shrub species such as beach heather, bayberry, and high-tide bush. Herbaceous species are sparse however; frequent canopy gaps support many species that are recruited from adjacent maritime grassland communities. These shrublands often occur in a mosaic with woodlands and forests dominated by Loblolly pine. Both occur on sheltered back dunes away from the primary dune where the effects of salt spray are minimal however, soil moisture is the major difference with woodlands typically restricted to rapidly drained, xeric dunes. Because these habitats have a restricted geographic range (Delaware to North Carolina) and narrow habitat requirements, they are considered globally uncommon to rare. Rangelwide, these habitats are threatened by coastal development and by natural and anthropogenic disturbances that destroy the protective primary dune system. However, in Maryland nearly all remaining habitat occurs on federal and state lands.

Location and Condition:

The best remaining example of maritime forests and shrubland habitats are in Worcester County on Assateague Island. Habitats on Assateague Island represent the largest contiguous blocks of maritime forests and shrublands stretching for approximately 22 miles into Virginia. Historically, portions of Fenwick Island were scattered with maritime forests and shrublands; however, the development of Ocean City and surrounding areas have virtually destroyed all remaining habitats on Fenwick Island. There are currently about 1,600 acres of maritime forests and shrublands in Maryland, of which 92.5% is owned by the federal government, 6.3% is owned by the state, and 1.2% is owned privately.

Figure 4.3 Location of Maritime Forests and Shrublands in Maryland (Sources: National Park Service, Assateague Island National Seashore; MD DNR NHP)



GCN Species, Rare Natural Communities, and Other Wildlife:

Mammals
Least shrew
Birds
American woodcock
Bicknell's thrush
Boat-tailed grackle
Brown thrasher
Brown-headed nuthatch
Chuck-will's-widow
Common nighthawk

Eastern towhee
Field sparrow
Hairy woodpecker
Northern bobwhite
Prairie warbler
Red-cockaded woodpecker
Red-headed woodpecker
Summer tanager
Reptiles
Broad-headed skink

Eastern hog-nosed snake
Inverts: Beetles
American burying beetle
Rare Natural Communities
Maritime Dune Loblolly Pine Forests
Maritime Dune Scrub
Maritime Dune Woodlands

In addition to the GCN species listed above, this key wildlife habitat supports a wide diversity of wildlife species. The following game species are found in this habitat type: white tailed deer, sika deer, eastern gray squirrel, red fox, common gray fox, common raccoon, Virginia opossum, striped skunk, long-tailed weasel, eastern cottontail, nutria, northern bobwhite, American woodcock, mourning dove, American crow, and fish crow. Management plans and conservation programs for these game species are currently being implemented by MD DNR, USFWS, and many other partners.

Threats:

- a. Conversion to other land uses or forest types that results in loss of habitat
- b. Pesticide use and contamination that directly or indirectly affects GCN species
- c. Incompatible management practices that result in degradation of habitat
- d. Development and land use, including roadways and trails that results in forest fragmentation and isolation
- e. Deer overbrowsing or other causes that result in loss of forest structural diversity
- f. Forest pest species that may have landscape level effects
- g. Invasive/exotic species that result in degradation of habitat
- h. Lack of scientific understanding of appropriate habitat requirements and management for all GCN species
- i. Sea-level rise
- j. Non-native feral horses on Assateague Island
- k. Increased human use that results in habitat degradation

Conservation Actions:

- a. **Conserve large blocks of contiguous forest where appropriate** *[Measure: # of acres contiguous forests conserved]*
- b. **Work with National Park Service and State Park managers to conserve this habitat on Assateague Island** *[Measure: # of acres conserved; # of cooperative projects implemented]*
- c. **Control non-native herbivore populations to reduce impacts to this habitat** *[Measure: # of control programs implemented and evaluated for effectiveness; # of acres with management implemented]*
- d. **Minimize fragmentation of large, contiguous forest blocks** *[Measure: % of large forest blocks remaining unfragmented]*
- e. **Maintain shrubland habitat, including all remaining on private lands** *[Measure: # of acres of shrubland habitat maintained; # of acres of privately-owned shrubland habitat maintained]*
- f. **Conserve appropriate corridors for movement and dispersal of GCN species** *[Measure: # of acres forest corridors conserved]*
- g. **Develop habitat management guidelines for use by foresters and land managers** *[Measure: guidelines developed]*
- h. **Incorporate forest conservation actions into land use and land planning efforts by local, state, and federal agencies** *[Measure: # of local, state, and federal agency plans incorporating forest wildlife focused habitat management actions]*
- i. **Limit access and educate the public about the conservation of this habitat and its GCN species to address increasing human use** *[Measure: # of sites with limited access and educational signage; # of educational materials developed and disseminated]*
- j. **Work with land managers to manage this habitat conductively for GCN species** *[Measure: # of sites with cooperative management project; # of acres of this habitat managed for GCN species]*
- k. **Develop and implement protocols to control invasive species in a manner compatible with GCN species** *[Measure: # of protocols developed; # of sites with management implemented]*
- l. **Limit the use of pesticides such that GCN species and this habitat are not adversely affected** *[Measure: # of sites or acres with reduced quantity or frequency of pesticide use]*
- m. **Develop and implement protocols to control deer populations to reduce browsing levels** *[Measure: protocols developed; # of sites or acres with management implemented]*
- n. **Restore degraded habitats through appropriate techniques** *[Measure: # of sites or acres with degraded habitat restored]*

- o. Implement appropriate IPM practices to minimize the effects of serious forest pest species *[Measure: # of sites or acres with IPM practices implemented]*

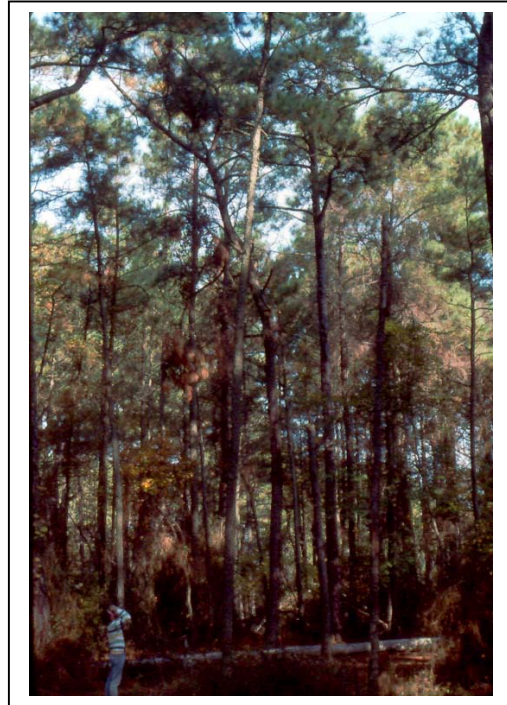
Inventory, Monitoring and Research Needs:

- a. Initiate long-term monitoring studies of GCN species *[Measure: # of monitoring studies established; # of monitoring studies conducted]*
- b. Conduct research on basic ecology, breeding parameters, and life histories of GCN species *[Measure: # of research projects conducted; # of research papers published]*
- c. Conduct research on habitat use and requirements of GCN species *[Measure: # of research projects conducted; # of research papers published]*
- d. Conduct species surveys and determine distribution and abundance of GCN species *[Measure: # of surveys completed]*
- e. Conduct research to determine movement patterns and dispersal of GCN species *[Measure: # of research projects conducted; # of research papers published]*
- f. Determine the effects of management activities on GCN species *[Measure: # of monitoring programs designed to assess effects of management actions]*

(4) Loblolly Pine - Oak Forests

Description:

On the Lower Coastal Plain, loblolly pine dominates many upland and wetland habitats. Upland habitats vary from dry to mesic, with sands or sandy loam soils on gently rolling topography. Various hardwoods are present and may include such species as southern red oak, white oak, and post oak. Other associates may include sassafras, pignut hickory, black oak, willow oak, white flowering dogwood, and sweetgum. On extremely dry sites where growing conditions are unfavorable, trees may not reach full stature and canopies are generally open. Shrubs are predominately ericaceous and are characterized by patches of huckleberries, blueberries, and mountain laurel. American holly is often dominant in the understory of more mesic sites. Herbs are generally sparse but may include pink lady's slipper, bracken fern, wintergreen, and spotted wintergreen. Loblolly pine also dominates many temporarily flooded wetlands such as "wet flatwoods" throughout the lower Eastern Shore. These habitats develop on broad flats between stream drainages, but may also occur on floodplains and isolated upland depressions. Loblolly pine swamps usually retain water throughout the winter months when water tables are high, but are relatively dry late in the growing season. Soils are best characterized as sandy loams. Associated trees may include red maple, black gum, pond pine, white oak, willow oak, swamp chestnut oak, American holly, and bayberry. Shrubs and vines are common and include species such as sweet pepperbush, southern bayberry, highbush blueberry, poison-ivy, and common greenbrier. Herbs are sparse, generally consisting of patches of slender spikegrass, broomsedge, partridge berry, wool grass, and various sedges.

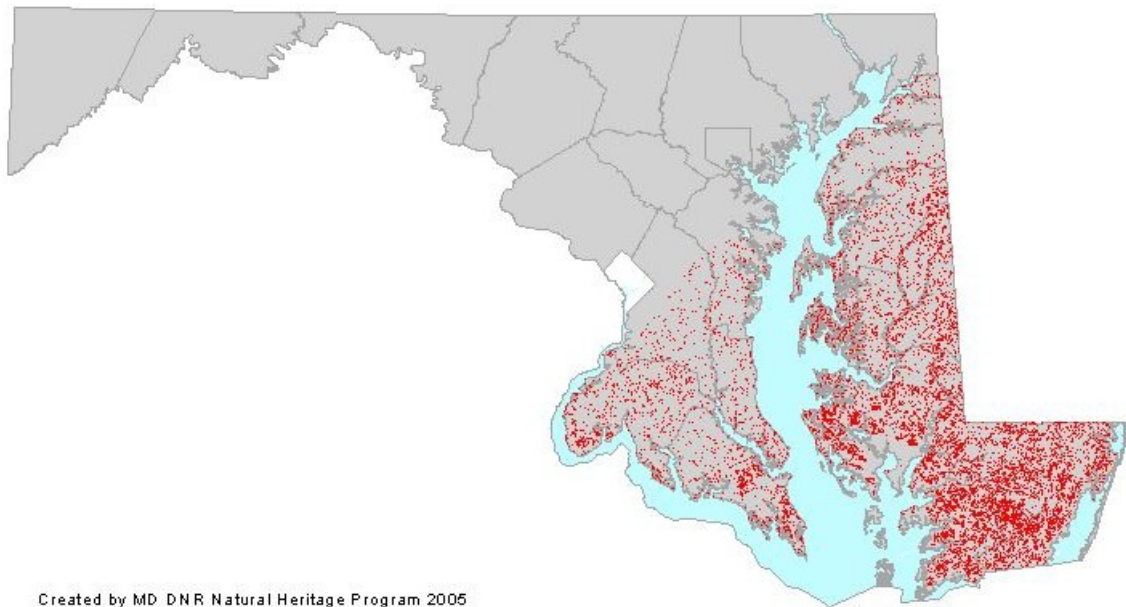


Location and Condition:

Natural loblolly pine-oak forests historically occurred throughout the lower portions of the Talbot formation reaching their northern limit in Kent and Queen Annes Counties (Shreve et al. 1910). During the time of Amerindian occupation, the Eastern Shore of Maryland was predominately hardwood dominated, though increasingly mixed with pine south of the Choptank River (Rountree and Davidson 1997). Although large stands exist, many of today's loblolly pine-oak stands are in second-growth form, the result of extensive clearing in historic times. In the nineteenth and early twentieth centuries loblolly pine became much more widespread, particularly south of the Choptank River largely due to economic factors. As an opportunistic species, loblolly pine was the first species to colonize abandoned farm fields (Shreve et al. 1910). In addition, recognizing the commercial value of loblolly pine, timber industries of the Eastern Shore accelerated the clearing of land and replanting of

pinus. Commercial logging industries also used steam locomotives to transport logs which were notorious for throwing sparks igniting widespread, intense fires during the late 1800s and early 1900s. Both the clearing of the forests by logging and the subsequent fires resulted in large areas of open, scarified land suitable for pine regeneration. By the middle of the twentieth century, loblolly pine was the dominant forest type in the lower counties of the Eastern Shore. Today's loblolly pine-oak stands are compositionally different than historical ones, most notably the hardwood component is not well-developed or absent altogether. Most of the natural loblolly pine-oak forests have been cutover in recent years and converted to pine plantations. Pine plantations are typically harvested on short rotations and trees rarely exceed 40 to 60 years in age. Species richness in plantations is dramatically lower than that of natural stands with canopy associates often limited to red maple and sweetgum and sparse or absent shrub and herb layers.

Figure 4.4 Location of Loblolly Pine - Oak Forests in Maryland (Sources: USGS MDN-GAP; MD DNR NHP)



GCN Species, Rare Natural Communities, and Other Wildlife:

Mammals
Delmarva fox squirrel
Eastern red bat
Southeastern shrew
Southern bog lemming
Southern pygmy shrew
Birds
Acadian flycatcher
American redstart
American woodcock
Bald eagle

Barred owl
Bicknell's thrush
Black-and-white warbler
Black-billed cuckoo
Brown-headed nuthatch
Chuck-will's-widow
Common nighthawk
Eastern towhee
Great blue heron
Great egret
Hairy woodpecker

Hooded warbler
Northern bobwhite
Ovenbird
Pileated woodpecker
Red-cockaded woodpecker
Red-eyed vireo
Red-headed woodpecker
Red-shouldered hawk
Scarlet tanager
Snowy egret
Summer tanager

Whip-poor-will
Wood thrush
Worm-eating warbler
Yellow-throated vireo
Reptiles
Broad-headed skink
Cornsnake

Eastern box turtle
Eastern hog-nosed snake
Northern pinesnake
Northern scarletsnake
Amphibians
Barking treefrog
Eastern narrow-mouthed toad

Eastern tiger salamander
New Jersey chorus frog
Rare Natural Communities
N/A

In addition to the GCN species listed above, this key wildlife habitat supports a wide diversity of wildlife species. The following game species are found in this habitat type: white-tailed deer, sika deer, eastern gray squirrel, red fox, common gray fox, coyote, common raccoon, Virginia opossum, striped skunk, long-tailed weasel, nutria, wild turkey, northern bobwhite, American woodcock, mourning dove, American crow, and fish crow. Management plans and conservation programs for these game species are currently being implemented by MD DNR, USFWS, and many other partners.

Threats:

- Conversion to other land uses or forest types that results in loss of habitat
- Pesticide use and contamination that directly or indirectly affects GCN species
- Incompatible management practices that result in degradation of habitat
- Development and land use, including roadways and trails that results in forest fragmentation and isolation
- Deer overbrowsing or other causes that result in loss of forest structural diversity
- Forest pest species that may have landscape level effects
- Invasive/exotic species that result in degradation of habitat
- Lack of scientific understanding of appropriate habitat requirements and management for all GCN species
- Loss or degradation of pine and oak barrens habitat
- Imbalanced vegetation structure and species composition

Conservation Actions:

- Conserve large blocks of contiguous forest where appropriate** *[Measure: # of acres contiguous forests conserved]*
- Conserve or restore pine and oak barrens habitat** *[Measure: # of acres pine and oak barren habitat conserved or restored]*
- Ensure adequate structural diversity, especially regarding canopy and understory components (shrubs, treefalls)** *[Measure: # of acres maintained with structural diversity]*
- Control the conversion of mixed stands to loblolly pine monocultures** *[Measure: # of acres mixed stands maintained]*
- Incorporate forest conservation actions into land use and land planning efforts by local, state, and federal agencies** *[Measure: # of local, state, and federal agency plans incorporating forest wildlife focused habitat management actions]*
- Conserve appropriate corridors for movement and dispersal of GCN species** *[Measure: # of acres forest corridors conserved]*

- g. **Develop habitat management guidelines for use by foresters and land managers and work with them to implement such** *[Measure: guidelines developed; # of sites with cooperative management project; # of acres of this habitat managed for GCN species]*
- h. Maintain forested areas in close proximity to large bodies of open water, especially tidal waters *[Measure: # of acres forested areas near water conserved]*
- i. Work with TNC to implement the Nanticoke River bioreserve strategy in conjunction with their ecoregional plan *[Measure: # of joint cooperative projects implemented; # of acres managed under cooperative projects]*
- j. Minimize fragmentation of large, contiguous forest blocks *[Measure: % of large forest blocks remaining unfragmented]*
- k. Protect and maintain habitat with dense thickets and downed logs within larger mature forest *[Measure: # of acres maintained with dense thickets and downed logs]*
- l. Modify the loblolly pine seed tree law to more easily allow for a mixed pine-hardwood forest *[Measure: law modified to more easily allow for mixed forest composition]*
- m. Discourage loblolly pine monocultures in favor of mixed stands of loblolly pine and hardwoods *[Measure: # of acres of pine monocultures converted to mixed stands]*
- n. Develop and implement protocols to control invasive species in a manner compatible with GCN species *[Measure: # of protocols developed; # of sites with management implemented]*
- o. Limit the use of pesticides such that GCN species and this habitat are not adversely affected *[Measure: # of sites or acres with reduced quantity or frequency of pesticide use]*
- p. Develop and implement protocols to control deer populations to reduce browsing levels *[Measure: protocols developed; # of sites or acres with management implemented]*
- q. Implement appropriate IPM practices to minimize the effects of serious forest pest species *[Measure: # of sites or acres with IPM practices implemented]*
- r. Restore degraded habitats through appropriate techniques *[Measure: # of sites or acres with degraded habitat restored]*
- s. Work with Maryland DOT to improve transportation planning for new roads to minimize fragmentation of habitat *[Measure: # or miles of new roads planned with comments/input to minimize forest fragmentation]*

Inventory, Monitoring and Research Needs:

- a. Initiate long-term monitoring studies of GCN species, including forest interior birds and Delmarva fox squirrel *[Measure: # of monitoring studies established; # of monitoring studies conducted]*
- b. Conduct research on basic ecology, breeding parameters, and life histories of GCN species, especially reptiles, amphibians, and invertebrates *[Measure: # of research projects conducted; # of research papers published]*
- c. Conduct research on habitat use and requirements of GCN species, especially reptiles, amphibians, and invertebrates *[Measure: # of research projects conducted; # of research papers published]*
- d. Conduct species surveys and determine distribution and abundance of GCN species *[Measure: # of surveys completed]*
- e. Conduct research to determine movement patterns and dispersal of GCN species *[Measure: # of research projects conducted; # of research papers published]*
- f. Determine the effects of development activities on GCN species, including Delmarva fox squirrel *[Measure: # of research projects conducted; # of research papers published]*

- g. Determine the effects of various timber harvest practices on GCN species, including forest interior birds, reptiles, amphibians, and Delmarva fox squirrel
[Measure: # of research projects conducted; # of research papers published]
- h. Determine historical range of this key wildlife habitat and target priority sites for monitoring and research *[Measure: historical range determined; # of priority monitoring and research sites established]*

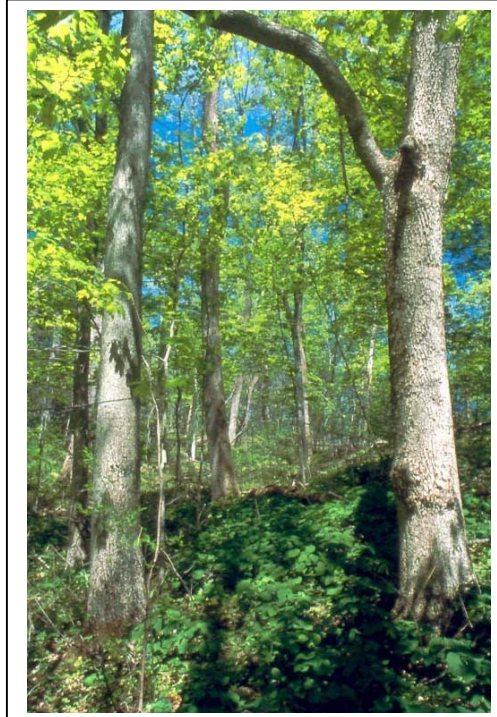
(5) Mesic Deciduous Forests

Description:

Mesic deciduous forests represent a broad group of forested habitats that occur throughout the Coastal Plain, Piedmont, and at low elevations in the Ridge and Valley and Appalachian Plateau physiographic provinces. These forests are found on both acidic and basic substrates and are characterized by an assortment of mixed hardwoods in moist habitats, such as sheltered ravines and coves, low mountain slopes, and well-drained terraces or flatwoods.

Many different forest types fall into this category and are largely distinguished from one another by species composition and by the substrate on which they develop. In general, mesic forests over acidic substrates contain mixed canopies of tulip poplar, American beech, oaks, and hickories and understories of white flowering dogwood, pawpaw, and American hornbeam. Many of the oaks and other associated trees of these forests vary by region. These forests are widespread

occurring throughout much of Maryland on moist low slopes, steep north-facing slopes, ravines, and well-drained uplands and occasionally in stream bottoms. Soils are characterized as acidic and nutrient-poor and rarely support lush layers of herbaceous vegetation, although species such as Christmas fern may be abundant in patches. Sheltered coves and slopes in mountainous regions often support very fertile habitats with lush herbaceous layers containing a diverse assemblage of spring ephemerals. The soils are weathered from various substrates but can range from moderately acidic to moderately alkaline. Trees common in these “rich cove forests” include basswood and sugar maple, and tulip poplar often characterizes the canopy. Cove forests may also occur on substrates underlain by acidic bedrock, such as sandstone or quartzite. A mixture of hemlock and hardwoods such as yellow birches and a dense understory of rhododendron distinguish these forests from rich cove forests. Herbaceous species are limited by dense shade and poor soils, and are much sparser and less diverse than in rich cove forests.



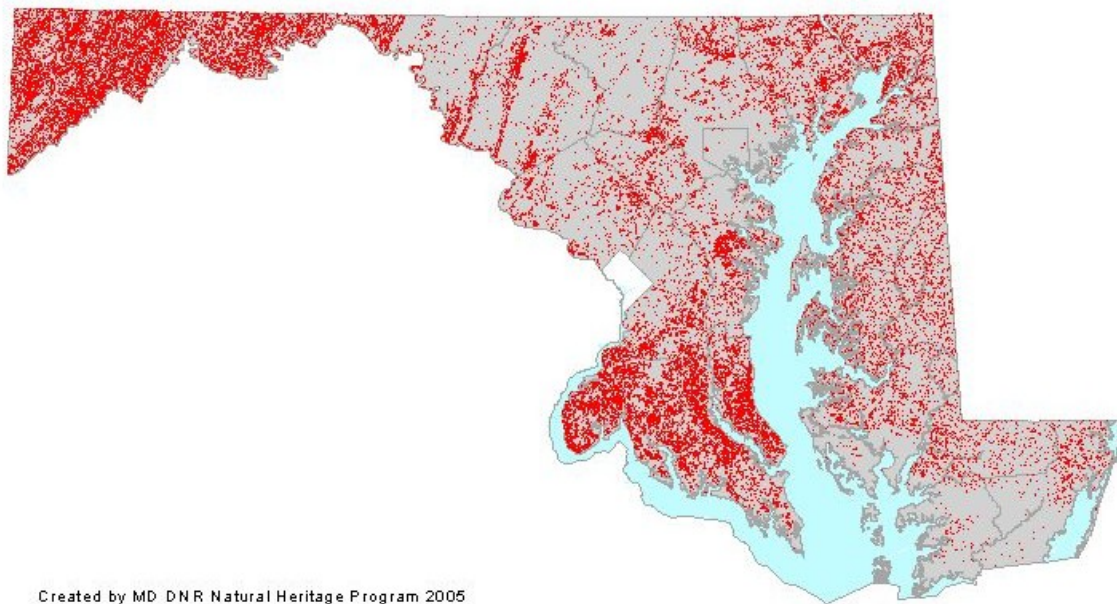
On the Coastal Plain, slightly drier forests dominated by American beech and oaks such as white oak, red oak, and chestnut oak occur on north-facing bluffs and steep ravine slopes. The soils are very acidic and nutrient-poor, providing unsuitable conditions for many mesophytic plants; however, shrubs of blueberries and huckleberries often form dense colonies. In Maryland, these forests are widely, but locally, distributed in small patches across the dissected Upper Coastal Plain, Lower Coastal Plain, and perhaps portions of the Piedmont near the fall line. In Maryland, forests that have developed over fertile basic substrates are found in the Coastal Plain, Piedmont, and major mountain valleys. Typical sites are deep ravines, sheltered north- or east-facing slopes subtending large streams and

rivers, and occasionally well-drained floodplain terraces. Soils are usually weathered from carbonate or mafic bedrock, or from calcareous, shell-rich deposits in the Coastal Plain. Many of these forests are similar in species composition to rich cove forests but also usually contain species such as chinkapin oak, bitternut hickory, white ash, eastern redbud, and eastern hophornbeam. The moist and fertile soils of these forests often support a lush and diverse herbaceous layer.

Location and Condition:

Although their quality and extent have been severely reduced by repeated logging, mesic deciduous forests are widespread throughout Maryland. Areas spared by logging are few and mostly limited to steep slopes, sheltered ravines and coves. Many areas have been selectively cut many times and have increased importance of species such as American beech and other noncommercial hardwoods relative to oaks. Other disturbed habitats have increased amounts of pines and weedy hardwoods such as tulip-tree and sweetgum. Very few mesic deciduous forests are free of invasion by garlic mustard, Japanese stiltgrass, and other shade tolerant exotic weeds. Some of the oldest and best remaining examples of this habitat can be found under state and federal ownership in Green Ridge State Forest, Belt Woods Natural Heritage Area, Chesapeake and Ohio Canal National Historical Park, and Fort Washington Historical Park.

Figure 4.5 Location of Mesic Deciduous Forests in Maryland (Source: USGS MDN-GAP)



GCN Species, Rare Natural Communities, and Other Wildlife:

Mammals
Allegheny woodrat
Bobcat
Delmarva fox squirrel
Eastern red bat

Eastern small-footed myotis
Eastern spotted skunk
Hoary bat
Indiana bat
Least weasel

Long-tailed shrew
New England cottontail
North American Porcupine
Silver-haired bat
Smoky shrew

Southeastern shrew
Southern bog lemming
Southern pygmy shrew
Southern water shrew
Birds
Acadian flycatcher
American redstart
Bald eagle
Barred owl
Bicknell's thrush
Black-and-white warbler
Black-billed cuckoo
Black-throated blue warbler
Black-throated green warbler
Broad-winged hawk
Brown creeper
Canada warbler
Cerulean warbler
Common raven
Dark-eyed junco
Eastern towhee
Great blue heron
Hairy woodpecker
Hooded warbler
Kentucky warbler
Least flycatcher
Northern parula
Ovenbird
Pileated woodpecker
Red-eyed vireo
Red-headed woodpecker
Red-shouldered hawk
Scarlet tanager

Sharp-shinned hawk
Veery
Whip-poor-will
Wood thrush
Worm-eating warbler
Yellow-throated vireo
Reptiles
Broad-headed skink
Cornsnake
Eastern box turtle
Eastern hog-nosed snake
Northern pinesnake
Northern scarletsnake
Timber rattlesnake
Wood turtle
Amphibians
Barking treefrog
Eastern narrow-mouthed toad
Eastern spadefoot
Eastern tiger salamander
Green salamander
Jefferson salamander
New Jersey chorus frog
Wehrle's salamander
Inverts: Butterflies & Moths
A noctuid moth
American chestnut nepticulid moth
Appalachian blue
Carolina satyr
Chestnut clearwing moth
Compton tortoiseshell
Dusky azure
Early hairstreak

Giant swallowtail
Golden-banded skipper
Gray comma
Hickory hairstreak
Marbled underwing
Northern crescent
Phleophagan chestnut nepticulid moth
Three-horned moth
West virginia white
Inverts: Beetles
A coccinellid beetle
American burying beetle
Giant stag beetle
Six-banded longhorn beetle
Inverts: Spiders
Red-legged purse-web spider
Inverts: Land Snails
Angular disc
Bear creek slitmouth
Cherrydrop snail
Cylindrically-ornate wood snail
Rader's snail
Rare Natural Communities
Rich Cove and Slope Forests
Basic Oak-Hickory Forests
Dry-Mesic Calcareous Forests
Low-Elevation Boulderfield Forests and Woodlands
Piedmont/Mountain Basic Woodlands

In addition to the GCN species listed above, this key wildlife habitat supports a wide diversity of wildlife species. The following game species are found in this habitat type: white-tailed deer, black bear, eastern gray squirrel, eastern fox squirrel, red fox, common gray fox, coyote, common raccoon, Virginia opossum, striped skunk, long-tailed weasel, mink, woodchuck, wild turkey, ruffed grouse, northern bobwhite, American woodcock, mourning dove, American crow, and fish crow. Management plans and conservation programs for these game species are currently being implemented by MD DNR, USFWS, and many other partners.

Threats:

- a. Conversion to other land uses or forest types that results in loss of habitat

- b. Pesticide use and contamination that directly or indirectly affects GCN species
- c. Incompatible management practices that result in degradation of habitat
- d. Development and land use, including roadways and trails that results in forest fragmentation and isolation
- e. Deer overbrowsing or other causes that result in loss of forest structural diversity
- f. Forest pest species that may have landscape level effects
- g. Invasive/exotic species that result in degradation of habitat
- h. Lack of scientific understanding of appropriate habitat requirements and management for all GCN species
- i. Human disturbance, including ATV use, which results in degradation of habitat

Conservation Actions:

- a. **Conserve large blocks of contiguous forest where appropriate** *[Measure: # of acres contiguous forests conserved]*
- b. **Control the conversion to other forest types** *[Measure: # of acres mesic deciduous forest protected from conversion]*
- c. **Establish and maintain landscape-scale protected habitat and movement corridors** *[Measure: # of existing targeted large forested patches connected by new corridors; # of acres new corridors established]*
- d. **Incorporate forest conservation actions into land use and land planning efforts by local, state, and federal agencies** *[Measure: # of local, state, and federal agency plans incorporating forest wildlife focused habitat management actions]*
- e. **Develop habitat management guidelines for use by foresters and land managers and work with them to implement such** *[Measure: guidelines developed; # of sites with cooperative management project; # of acres of this habitat managed for GCN species]*
- f. **Minimize fragmentation of large, contiguous forest blocks** *[Measure: % of large forest blocks remaining unfragmented]*
- g. **Increase presence of snags and vertical structure complexity to enhance existing habitat** *[Measure: # of acres managed to increase presence of snags and vertical structure complexity]*
- h. **Incorporate appropriate forest management practices into forest stewardship plans** *[Measure: # of forest stewardship plans with forest wildlife focused habitat management guidelines incorporated]*
- i. **Educate the public about the value of these forests and their conservation to address human disturbance issues** *[Measure: # of educational materials developed and disseminated]*
- j. **Restore chestnut component where feasible** *[Measure: # of acres with restored chestnut component]*
- k. **Develop and implement protocols to control invasive species in a manner compatible with GCN species** *[Measure: # of protocols developed; # of sites with management implemented]*
- l. **Limit the use of pesticides such that GCN species and this habitat are not adversely affected** *[Measure: # of sites or acres with reduced quantity or frequency of pesticide use]*
- m. **Develop and implement protocols to control deer populations to reduce browsing levels** *[Measure: protocols developed; # of sites or acres with management implemented]*
- n. **Implement appropriate IPM practices to minimize the effects of serious forest pest species** *[Measure: # of sites or acres with IPM practices implemented]*
- o. **Restore degraded habitats through appropriate techniques** *[Measure: # of sites or acres with degraded habitat restored]*

- p. Work with Maryland DOT to improve transportation planning for new roads to minimize fragmentation of habitat *[Measure: # or miles of new roads planned with comments/input to minimize forest fragmentation]*

Inventory, Monitoring and Research Needs:

- a. Initiate long-term monitoring studies of GCN species, including forest interior birds *[Measure: # of monitoring studies established; # of monitoring studies conducted]*
- b. Conduct research on basic ecology, breeding parameters, and life histories of GCN species, especially reptiles, amphibians, and invertebrates *[Measure: # of research projects conducted; # of research papers published]*
- c. Conduct research on habitat use and requirements of GCN species, especially reptiles, amphibians, and invertebrates *[Measure: # of research projects conducted; # of research papers published]*
- d. Conduct species surveys and determine distribution and abundance of GCN species *[Measure: # of surveys completed]*
- e. Conduct research to determine movement patterns and dispersal of GCN species *[Measure: # of research projects conducted; # of research papers published]*
- f. Determine the effects of various timber harvest practices on GCN species, including forest interior birds, reptiles, amphibians *[Measure: # of research projects conducted; # of research papers published]*
- g. Assess the effects of gypsy moth spraying on GCN species *[Measure: # of research projects conducted; # of research papers published]*

(6) Dry Oak - Pine Forests

Description:

Dry oak-pine forests are a broad group of dry upland forests and woodlands. They occur on highly droughty, infertile soils that range from strongly acidic or basic. The associated plant communities are structurally intermediate between more mesic forests and ultra-xeric barrens and glades and, on many sites, may represent an ecotone between these two contrasting conditions. Examples of dry oak-pine forests occur in each



physiographic region but the plant communities and site conditions differ markedly among the various types. Most of these habitats are kept from succeeding to closed forests or more mesic conditions by periodic fire, edaphic factors, insects (e.g., southern pine beetle), disease (e.g., sweet fern rust) and/or generally harsh growing conditions associated with mountain ridgetop settings.

This habitat is most widely represented by several oak-dominated plant communities. These occur in each of the five physiographic regions but are most prevalent west of the fall line. In the Ridge and Valley and Allegheny Plateau physiographic regions, it commonly occurs on upper, rocky mountain slopes and ridgetops overlying sandstone (Pottsville, Oriskany, Tuscarora) and quartzite (Weaverton) formations. In the Piedmont, it also exists on submesic to subxeric upland habitats over subacidic rocks such as siltstone, metasiltstone, shale, and certain granites. These areas are typically dominated by chestnut oak mixed with other oaks. Mountain laurel, blueberry, and huckleberry are common understory shrubs, often occurring as dense patches. Variants of these communities also frequently occur in xeric sandy areas on the Upper and Lower Coastal Plain. The soils exhibit a distinctly oligotrophic nutrient regime, i.e., strongly acidic, with low base cation levels and relatively high levels of iron. Accumulations of thick duff and high biomass of inflammable shrubs in these forests make them susceptible to periodic fires, which in turn favors recruitment of oaks. In some cases, particularly in the mountains, these communities have replaced former mixed oak–American chestnut forests following the decimation of American chestnut canopy trees during the early 20th century by chestnut blight, an introduced fungus.

In the Ridge and Valley and, to a lesser degree, the Allegheny Plateau, this habitat is also represented by xeric pine-dominated (table-mountain pine, pitch pine, and/or Virginia pine) woodlands. These are species-poor, fire-influenced communities. They are typically located along ridgetop outcrops, on convex south to west facets of steep spur ridges, narrow rocky crests, and cliff tops. They occur on a variety of soils but most commonly on acidic,

sedimentary and metasedimentary substrates, e.g., sandstone, quartzite, and shale. Soils are very infertile, shallow, and droughty. Thick, poorly decomposed duff layers, along with dead wood and inflammable shrubs, make these habitats susceptible to fire.

On the Lower Coastal Plain, this habitat occurs, in part, on inland sand dune ridges which overly deep, late to post-Pleistocene deposits of Parsonsburg sands. Referred to as xeric sand ridge woodlands, this type of dry oak-pine forest is uncommon and mostly restricted to the lower Eastern Shore. Many areas have been replaced or degraded by development, agriculture and commercial forestland. The canopy is typically semi-open and dominated by a mix of loblolly pine, shortleaf pine, pitch pine, sand hickory, southern red oak, and black jack oak. The understory is somewhat dense to open with scattered huckleberry, blueberry, sweet fern, and sand blackberry. The herb layer is sparse to open with scattered lichens, dry leaf litter, and exposed patches of whitish sand.

Dry oak-pine forests also include several types of dry calcareous woodlands and forests. On the Lower Coastal Plain, these exist as rare, localized, predominately hardwood forests and woodlands. They are nearly restricted to the upper Eastern Shore where they occur on steep, convex, south-facing slopes of deep ravines and stream-fronting bluffs that have downcut into Tertiary shell deposits. Examples can found along the upper portions of the Chesapeake Bay and tributaries of the Chester and Sassafras rivers. Soils are circumneutral to slightly alkaline with high calcium levels. The tree canopy ranges from semi-closed to very open and is characterized by chinquapin oak, hickories, and hackberry. The understory and herb layers are usually sparse to open. Characteristic herbaceous species include Robin's plantain, Bosc's panic grass, and slender wild rye.

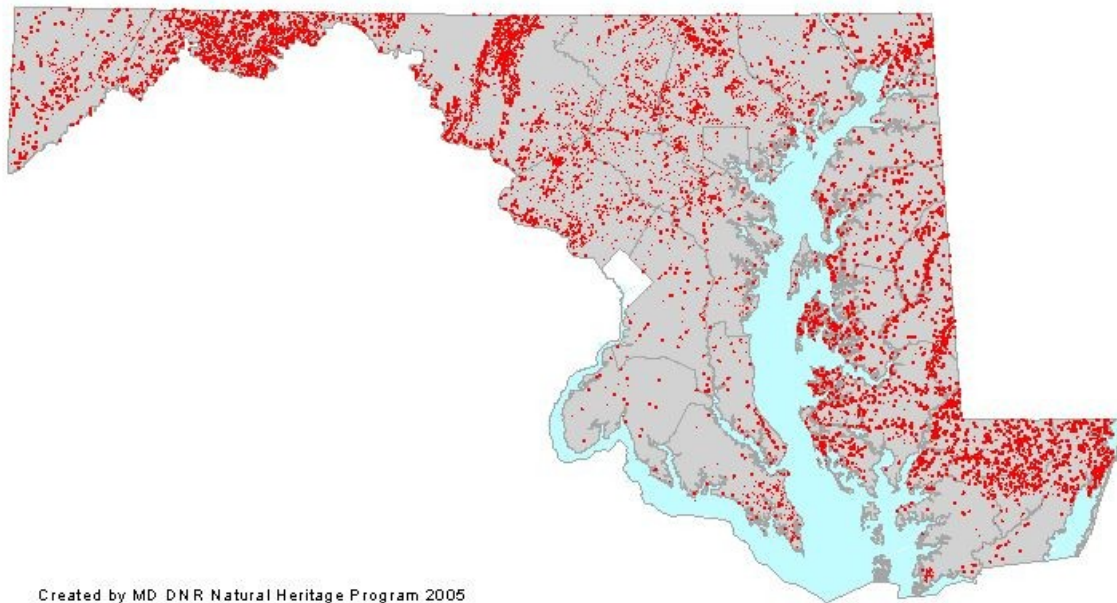
Dry and dry-mesic calcareous forests and woodlands also occur, uncommonly, in western Maryland on steep, rocky south- to west-facing slopes at elevations of 400-900 m over carbonate formations of limestone or dolomite. Soils vary from circumneutral to moderately alkaline, and exhibit high calcium levels. As with the coastal plain type, characteristic trees include chinquapin oak, sugar maple and redbud. The understory and herb layers are variable from sparse to rich, depending on soil moisture, slope, aspect and elevation.

Location and Condition:

Dry-oak pine forests are a dominant habitat type on the mid- to upper slopes of many of the mountain ridges of western Maryland and hillsides in the Piedmont. However, their extent and condition have been greatly reduced by forest loss, fragmentation, logging, fire suppression and invasive plant species. Because of the predominance of oak, this habitat is particularly vulnerable to gypsy moth damage although, to some degree, infestations can mimic natural disturbance processes (e.g., scattered light gaps, increased structural diversity and coarse woody debris) that might otherwise be altered due to fire suppression, logging and other anthropogenic influences. On the Lower Coastal Plain, many of the largest remaining tracts occur along the leeward or eastern sides of the Pocomoke River, Nanticoke River and Marshyhope Creek and along some of their tributaries (e.g., Nassawango Creek). The condition of these "sand ridge" communities has been degraded by by fire suppression, logging, and conversion to loblolly pine stands. In addition, large acreages have been converted to cropland, residential development, and sand and gravel mining operations.

Calcareous variants of this habitat are rare to uncommon, and confined to small, scattered sites on the upper Eastern Shore and western Maryland.

Figure 4.6 Location of Dry Oak - Pine Forests in Maryland (Sources: USGS MDN-GAP; USDA SCS STATSGO)



GCN Species, Rare Natural Communities, and Other Wildlife:

Mammals	Common raven	Timber rattlesnake
Allegheny woodrat	Eastern towhee	Amphibians
Bobcat	Hairy woodpecker	Eastern narrow-mouthed toad
Eastern harvest mouse	Northern bobwhite	Eastern spadefoot
Eastern red bat	Ovenbird	Inverts: Butterflies & Moths
Eastern small-footed myotis	Pileated woodpecker	A noctuid moth
Eastern spotted skunk	Red-eyed vireo	American chestnut nepticulid moth
Indiana bat	Red-headed woodpecker	Chestnut clearwing moth
Least weasel	Scarlet tanager	Cobweb skipper
New England cottontail	Summer tanager	Dotted skipper
North American Porcupine	Whip-poor-will	Edwards' hairstreak
Silver-haired bat	Wood thrush	Frosted elfin
Birds	Worm-eating warbler	Giant swallowtail
Acadian flycatcher	Yellow-throated vireo	Hoary elfin
Bachman's sparrow	Reptiles	Mottled duskywing
Bicknell's thrush	Broad-headed skink	Northern metalmark
Black-and-white warbler	Cornsnake	Persius duskywing
Black-billed cuckoo	Eastern box turtle	Phleophagan chestnut nepticulid moth
Broad-winged hawk	Eastern hog-nosed snake	Pine barrens zanclognatha
Chuck-will's-widow	Northern pinesnake	Silvery blue
Common nighthawk	Northern scarletsnake	

Tawny crescent
The buckmoth
Inverts: Beetles
American burying beetle
Big sand tiger beetle
Cow Path Tiger Beetle
Eastern pinebarrens tiger beetle

Festive Tiger Beetle
Northern Barrens Tiger Beetle
One-spotted Tiger Beetle
Splendid Tiger Beetle
Inverts: Spiders
Red-legged purse-web spider

Rare Natural Communities
Coastal Plain Dry Calcareous Forests and Woodlands
Montane Acidic Woodlands
Montane Dry Calcareous Forests and Woodlands
Pine-Oak/Heath Forests and Woodlands
Sand Ridge/Inland Dune Woodlands

In addition to the GCN species listed above, this key wildlife habitat supports a wide diversity of wildlife species. The following game species are found in this habitat type: white-tailed deer, black bear, eastern gray squirrel, eastern fox squirrel, red fox, common gray fox, coyote, common raccoon, Virginia opossum, striped skunk, long-tailed weasel, woodchuck, wild turkey, ruffed grouse, northern bobwhite, mourning dove, American crow, and fish crow. Management plans and conservation programs for these game species are currently being implemented by MD DNR, USFWS, and many other partners.

Threats:

- Conversion to other land uses or forest types that results in loss of habitat
- Pesticide use and contamination that directly or indirectly affects GCN species
- Incompatible management practices that result in degradation of habitat
- Development and land use, including roadways and trails that results in forest fragmentation and isolation
- Deer overbrowsing or other causes that result in loss of forest structural diversity
- Forest pest species that may have landscape level effects
- Invasive/exotic species that result in degradation of habitat
- Lack of scientific understanding of appropriate habitat requirements and management for all GCN species
- Forest conversion to pine plantations
- Windpower development on ridgetops that results in loss of habitat
- Exclusion of natural fire regimes that promotes conversion of habitat
- Sudden oak death that causes loss of oak component
- Human disturbance, including ATV use, that results in degradation of habitat

Conservation Actions:

- Re-establish natural fire regimes to restore and maintain habitats** *[Measure: # of acres maintained with controlled burn program; # of sites with natural fire regimes allowed]*
- Conserve large blocks of contiguous forest where appropriate** *[Measure: # of acres contiguous forests conserved]*
- Control the conversion of this habitat to pine plantations** *[Measure: # of acres dry oak pine forests protected from conversion]*
- Conserve appropriate corridors for movement and dispersal of GCN species** *[Measure: # of acres forest corridors conserved]*
- Minimize fragmentation of large, contiguous forest blocks** *[Measure: % of large forest blocks remaining unfragmented]*
- Develop habitat management guidelines for use by foresters and land managers and work with them to implement such** *[Measure: guidelines developed; # of sites with cooperative management project; # of acres of this habitat managed for GCN species]*

- g. **Incorporate forest conservation actions into land use and land planning efforts by local, state, and federal agencies** *[Measure: # of local, state, and federal agency plans incorporating forest wildlife focused habitat management actions]*
- h. Work through the Public Service Commission to reduce impacts of wind farms on this habitat and associated GCN species *[Measure: # of wind farm plans approved by Public Service Commission with input to mitigate impacts]*
- i. Educate the public about the value of these forests and their conservation, especially addressing human disturbance issues *[Measure: # of educational materials developed and disseminated]*
- j. Develop and implement protocols to control invasive species in a manner compatible with GCN species *[Measure: # of protocols developed; # of sites with management implemented]*
- k. Limit the use of pesticides such that GCN species and this habitat are not adversely affected *[Measure: # of sites or acres with reduced quantity or frequency of pesticide use]*
- l. Develop and implement protocols to control deer populations to reduce browsing levels *[Measure: protocols developed; # of sites or acres with management implemented]*
- m. Implement appropriate IPM practices to minimize the effects of serious forest pest species *[Measure: # of sites or acres with IPM practices implemented]*
- n. Restore degraded habitats through appropriate techniques *[Measure: # of sites or acres with degraded habitat restored]*
- o. Work with Maryland DOT to improve transportation planning for new roads to minimize fragmentation of habitat *[Measure: # or miles of new roads planned with comments/input to minimize forest fragmentation]*

Inventory, Monitoring and Research Needs:

- a. Initiate long-term monitoring studies of GCN species, including forest interior birds *[Measure: # of monitoring studies established; # of monitoring studies conducted]*
- b. Conduct research on basic ecology, breeding parameters, and life histories of GCN species, especially reptiles, amphibians, and invertebrates *[Measure: # of research projects conducted; # of research papers published]*
- c. Conduct research on habitat use and requirements of GCN species, especially reptiles, amphibians, and invertebrates *[Measure: # of research projects conducted; # of research papers published]*
- d. Conduct species surveys and determine distribution and abundance of GCN species, especially insects *[Measure: # of surveys completed]*
- e. Conduct research to determine movement patterns and dispersal of GCN species *[Measure: # of research projects conducted; # of research papers published]*
- f. Determine the effects of development activities on GCN species *[Measure: # of research projects conducted; # of research papers published]*

(7) Northern Conifer - Hardwood Forests

Description:

This habitat comprises two sub-boreal forest types, northern conifers and northern hardwoods. In Maryland, northern conifer-hardwood forests grow primarily on the Allegheny Plateau, typically on mesic sites above 600 m, as forest ecotones bordering high elevation wetlands, along stream bottoms and north-facing slopes, and in deep ravines. In northern conifer forests, eastern hemlock, red spruce, and/or white pine is co-dominant or

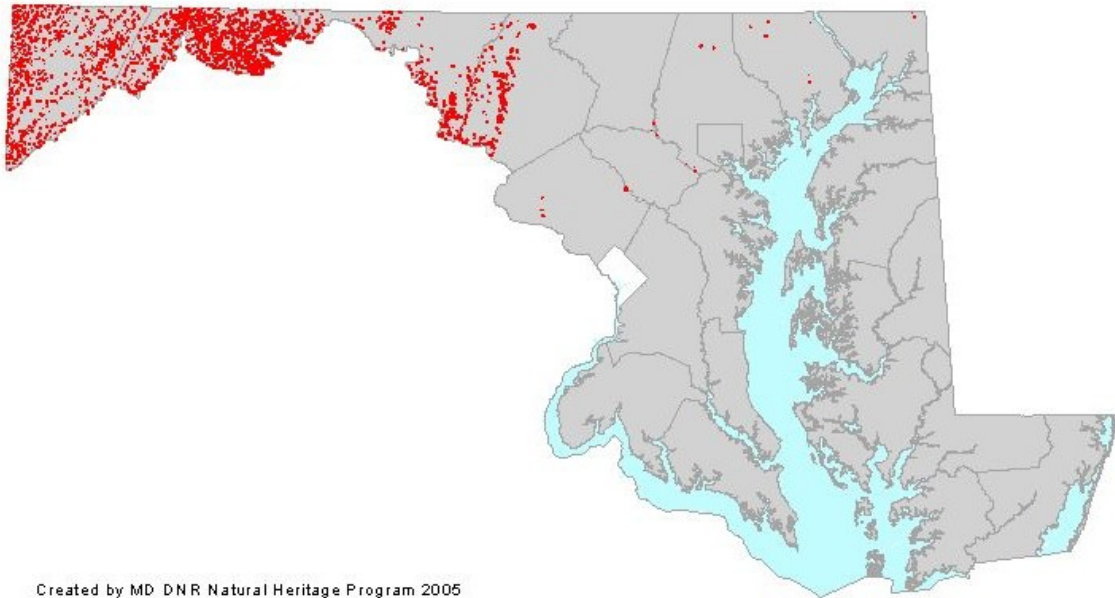


dominant, and often mixed with northern hardwoods. Northern hardwood forests are dominated by sugar maple, yellow birch, and black cherry. Associates include basswood, white ash, northern red oak, red maple, American beech, and northern conifers. In both forest types, common midstory and understory species include striped maple, witch hazel, maple-leaf viburnum, and frequently dense patches of great laurel and mountain laurel. The herb layer is often quite diverse, especially in less acidic soils. In the Ridge and Valley physiographic region, this habitat is much more limited and mostly confined to mesic, north-facing slopes and stream ravines where eastern hemlock, white pine and northern hardwoods may be dominant. White pine also occurs as a dominant or co-dominant on drier slopes in association with various oaks and hickories, particularly in Allegany County. In the Piedmont and Coastal Plain, this habitat is rare and restricted to scattered, isolated sites on steep, mesic, north-facing slopes, ravines and stream valleys where eastern hemlock is a dominant or co-dominant.

Location and Condition:

Most of the state's remaining northern conifer-hardwood forests occur on the Allegheny Plateau followed by the Ridge and Valley where it is more local in distribution. The overall extent and quality of this habitat has been greatly diminished by logging, conversion to agriculture, strip mining and residential development. During the late 19th and early 20th centuries, logging all but eliminated most remaining tracts of old growth condition of this forest. On the Allegheny Plateau, red spruce was nearly logged out. Most of the few remaining forests containing red spruce are now confined to high elevation bog wetland systems. The extent and dominance of white pine, a highly sought after and formerly much more common tree species, has also been greatly reduced. In recent years, eastern hemlock has been impacted by infestations of hemlock wooly adelgid an accidentally introduced insect pest. Hemlock stands in the Blue Ridge, Piedmont and Coastal Plain have been particularly hard hit. Widespread declines in hemlock could have severe ripple effects on other flora and fauna dependant on hemlock-dominated forests.

Figure 4.7 Location of Northern Conifer - Hardwood Forests in Maryland (Sources: USGS MDN-GAP; MD DNR NHP)



GCN Species, Rare Natural Communities, and Other Wildlife:

Mammals	Barred owl	Ovenbird
Allegheny woodrat	Bicknell's thrush	Pileated woodpecker
American marten	Black-and-white warbler	Red-breasted nuthatch
Bobcat	Black-billed cuckoo	Red-eyed vireo
Eastern red bat	Blackburnian warbler	Scarlet tanager
Eastern small-footed myotis	Black-throated blue warbler	Sharp-shinned hawk
Eastern spotted skunk	Black-throated green warbler	Swainson's thrush
Hoary bat	Blue-headed vireo	Veery
Indiana bat	Broad-winged hawk	Whip-poor-will
Least weasel	Brown creeper	Winter wren
Long-tailed shrew	Canada warbler	Wood thrush
New England cottontail	Common raven	Worm-eating warbler
North American Porcupine	Dark-eyed junco	Yellow-bellied sapsucker
Northern flying squirrel	Golden-crowned kinglet	Yellow-throated vireo
Silver-haired bat	Hairy woodpecker	Reptiles
Smoky shrew	Hermit thrush	Eastern box turtle
Snowshoe hare	Hooded warbler	Timber rattlesnake
Southern bog lemming	Least flycatcher	Amphibians
Southern pygmy shrew	Long-eared owl	Green salamander
Southern rock vole	Magnolia warbler	Jefferson salamander
Southern water shrew	Nashville warbler	Wehrle's salamander
Birds	Northern goshawk	Inverts: Butterflies & Moths
Acadian flycatcher	Northern parula	Appalachian blue
American redstart	Northern saw-whet owl	Compton tortoiseshell

Dusky azure
Early hairstreak
Gray comma
Olympia marble
Three-horned moth
West virginia white

Inverts: Land Snails
Angular disc
Bear creek slitmouth
Spruce knob threetooth
Rare Natural Communities

Central Appalachian Northern Hardwood Forests
Central Appalachian Red Spruce Forests
Acidic Cove Forests
Eastern Hemlock Forests
Eastern White Pine-Hardwood Forests

In addition to the GCN species listed above, this key wildlife habitat supports a wide diversity of wildlife species. The following game species are found in this habitat type: white-tailed deer, black bear, eastern gray squirrel, red squirrel, red fox, common gray fox, coyote, common raccoon, Virginia opossum, striped skunk, long-tailed weasel, fisher, mink, wild turkey, ruffed grouse, and American crow. Management plans and conservation programs for these game species are currently being implemented by MD DNR, USFWS, and many other partners.

Threats:

- a. Conversion to other land uses or forest types that results in loss of habitat
- b. Pesticide use and contamination that directly or indirectly affects GCN species
- c. Incompatible silviculture practices that result in degradation of habitat
- d. Development and land use, including roadways and trails that results in forest fragmentation and isolation
- e. Deer overbrowsing or other causes that result in loss of forest structural diversity
- f. Forest pest species that may have landscape level effects
- g. Invasive/exotic species that result in degradation of habitat
- h. Lack of scientific understanding of appropriate habitat requirements and management for all GCN species
- i. Forest pests that cause loss of spruce component of forests
- j. Hemlock wooly adelgid and other forest pests that cause loss of hemlock component of forests
- k. Deer overbrowsing or other causes that result in loss of forest structural diversity
- l. Acid precipitation
- m. Development of wind farms on ridgetops that result in loss of habitat

Conservation Actions:

- a. **Maintain conifer component of forest or restore such where appropriate** *[Measure: # of acres with conifer component maintained; # of acres with conifer component restored]*
- b. **Conserve large blocks of contiguous forest where appropriate** *[Measure: # of acres contiguous forests conserved]*
- c. **Minimize fragmentation of large, contiguous forest blocks** *[Measure: % of large forest blocks remaining unfragmented]*
- d. **Establish and maintain landscape-scale protected habitat and movement corridors** *[Measure: # of existing targeted large forested patches connected by new corridors; # of acres new corridors established]*
- e. **Develop and implement protocols to control invasive species in a manner compatible with GCN species** *[Measure: # of protocols developed; # of sites with management implemented]*
- f. **Work through the Public Service Commission to reduce impacts of wind farms on this habitat and associated GCN species** *[Measure: # of wind farm plans approved by Public Service Commission with input to mitigate impacts]*
- g. **Incorporate forest conservation actions into land use and land planning efforts by local, state, and federal agencies** *[Measure: # of local, state, and federal agency plans incorporating forest wildlife focused habitat management actions]*
- h. **Develop habitat management guidelines for use by foresters and land managers and work with them to implement such** *[Measure: guidelines developed; # of sites with cooperative management project; # of acres of this habitat managed for GCN species]*
- i. **Limit the use of pesticides such that GCN species and this habitat are not adversely affected** *[Measure: # of sites or acres with reduced quantity or frequency of pesticide use]*
- j. **Develop and implement protocols to control deer populations to reduce browsing levels** *[Measure: protocols developed; # of sites or acres with management implemented]*
- k. **Implement appropriate IPM practices to minimize the effects of serious forest pest species** *[Measure: # of sites or acres with IPM practices implemented]*
- l. **Restore degraded habitats through appropriate techniques** *[Measure: # of sites or acres with degraded habitat restored]*
- m. **Work with Maryland DOT to improve transportation planning for new roads to minimize fragmentation of habitat** *[Measure: # or miles of new roads planned with comments/input to minimize forest fragmentation]*

Inventory, Monitoring and Research Needs:

- a. **Initiate long-term monitoring studies of GCN species, including forest interior birds and boreal mammals** *[Measure: # of monitoring studies established; # of monitoring studies conducted]*
- b. **Conduct research on basic ecology, breeding parameters, and life histories of GCN species, especially boreal mammals, reptiles, amphibians, and invertebrates** *[Measure: # of research projects conducted; # of research papers published]*
- c. **Conduct research on habitat use and requirements of GCN species, especially boreal mammals, reptiles, amphibians, and invertebrates** *[Measure: # of research projects conducted; # of research papers published]*
- d. **Conduct species surveys and determine distribution and abundance of GCN species** *[Measure: # of surveys completed]*

- e. Conduct research to determine movement patterns and dispersal of GCN species *[Measure: # of research projects conducted; # of research papers published]*
- f. Investigate the effects of invasive species, gypsy moth spraying, and deer overbrowsing on GCN species *[Measure: # of research projects conducted; # of research papers published]*
- g. Assess the impacts of wooly adelgid on this habitat *[Measure: # of research projects conducted; # of research papers published]*